Y2K Critical Vulnerable Systems

Compliance Testing Guidance

JUNE 1999

INTRODUCTION

At the turn of the century, equipment with clock or date functionality may malfunction or shut down unless it has a four-digit year-dating system. The use of only two digits—for example, "03" to denote 2003—may result in the storing of the incorrect date (e.g., 1903 rather than 2003) or in the loss of date- and time-specific controls, which will in turn cause arithmetic errors in computations and problems in the sorting of calendar year data.

While information technology systems receive most of the publicity about the impact of Year 2000, non-IT equipment also will be affected. Examples of such equipment are heating, ventilation, and air conditioning (HVAC) systems that shut down automatically after normal business hours; cash registers that provide dated receipts; building systems that monitor the time of scheduled maintenance; and intrusion-detection devices that record the date and time on tape.

Government agencies have undertaken a massive effort to bring their non-IT equipment into Year 2000 compliance. The U.S. Department of Agriculture (USDA) is no exception. The USDA comprises many different agencies, each with a unique mission and vulnerability to non-IT Y2K-related problems. Agency responsibilities range from providing food assistance to low-income households to managing agricultural research, conservation, and land management programs. To carry out its responsibilities, the USDA has offices or committees in nearly every county in the United States. The offices are located in buildings that the department owns or leases, either directly or through the General Services Administration (GSA). These buildings have many different facility- and security-related systems that may be affected by the Y2K problem.

Because it recognizes that not all non-IT equipment is of "equal" value in supporting an agency's mission, the USDA is focusing its Y2K program on ensuring that its critical vulnerable systems (CVSs) supporting high-impact program delivery are Y2K compliant. The USDA defines a CVS as "equipment with an embedded computer chip or other non-IT related technology, the failure of which would prevent or seriously hamper a USDA agency/organization from delivering its core mission activities in a timely manner." USDA's overall approach to managing its Y2K non-IT program is based on concepts and methods outlined by the General Accounting Office (GAO). To accomplish its Y2K non-IT program, USDA identified the following key phases:

υ   Awareness—disseminate information about the Year 2000 non-IT problem throughout the department. This phase is being conducted simultaneously with the other four phases of the Y2K non-IT program and will continue through the months leading up to the century change.

υ   Assessment—evaluate the magnitude of the Y2K non-IT problem at USDA. For non-IT equipment, assessment encompasses contacting product manufacturers to determine compliance status and/or conducting Y2K simulation testing.

υ   Renovation—modify or replace noncompliant equipment to bring it into Year 2000 compliance.

υ   Validation—test equipment to verify compliance.

υ   Contingency planning—develop and, if necessary, activate contingency plans.[1]

This report describes the methodology and schedule that LMI recommends for conducting the Y2K validation program at USDA. The guidance is based on concepts and methods outlined by *Year 2000 Computer Crisis: A Testing Guide*, published by GAO in June 1998, and *Meeting the Year 2000 Challenge: A Guide for Property Professionals*, published by the Building Owners and Managers Association, as well as our experience with a number of other federal government organizations that have successfully completed their non-IT Y2K testing programs.

Throughout this report, we use the following terms:

υ   Non-IT system—a group of products with similar functionality (programmable thermostats, postage meters, fire alarms, scientific laboratory equipment). Non-IT systems include those pieces of equipment that are not typically used for data processing but that may have embedded date control logic or firmware that may be impacted by Year 2000 date-processing or logic errors.

υ   Product—equipment identifiable by manufacturer and model number (Panasonic PV-L606, Simplex 4100, Ascom Hasler S355).

υ   Item—a single piece of equipment (one Panasonic PV-L606 camcorder). USDA may have many items of a particular product (25 Panasonic PV-L606 camcorders).

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[1] GAO refers to this phase as "implementation." We use "contingency planning" because, for non-IT systems, it is the primary task that must be done.

TESTING METHODOLOGY

To ensure that all of their CVSs are Y2K compliant, USDA agencies and offices should conduct Y2K testing programs designed to do the following:

- υ Determine the Y2K compliance status for the products that the compliance status could not be determined through manufacturer contact

- υ Validate manufacturer statements about the Y2K compliance of their products

- υ Verify that replaced or repaired products are in fact Y2K ready.

Validation testing of Y2K non-IT product compliance requires the following steps:

- υ Development of testing protocol

- υ Identification of products to be tested

- υ Development of test plans

- υ Testing of the products

- υ Analysis of results.

Develop Testing Protocol

USDA agencies and offices should use a standard testing protocol. The protocol should include verifying that the equipment can be located and is in use, reviewing equipment documentation (e.g., the owners manual), and verifying that the equipment has a date/clock function. The protocol also should establish specific dates to be tested. In addition to future dates, we recommend that a regressed date be tested to ensure that the clock can be reset manually. We suggest that the following dates be tested at a minimum: October 1, 1995 (or any other regressed date); December 31, 1999; February 28, 2000; February 29, 2000; and December 31, 2000. If necessary for more complex or multicomponent systems, such as an energy management control system, USDA agencies or offices should schedule equipment tests so that the local equipment manufacturer, vendor's representative, or operations and maintenance (O&M) contractor can attend to provide technical support.

Identify Products to Be Tested

USDA should test a sampling (using the methodology outlined below) of all CVS products, including CVSs that the manufacturer has indicated are Y2K compliant, products that the Y2K compliance could not be determined through manufacturer

contact (i.e., "unknowns"), and noncompliant equipment that has been replaced or repaired.

The agency or office should prepare a list of CVS products that they own and, for each, should indicate the compliance status of the product—compliant, noncompliant, or unknown. For noncompliant products, the list should indicate whether the product has been renovated. For products with unknown Y2K compliance status, USDA should verify that there is not an inventory error (i.e., incorrect manufacturer name or model number).

Develop Test Plans

For each product requiring testing, USDA must determine the number of items that should be tested to ensure confidence in the results; identify the specific items to be tested, including their location; and identify the qualifications of the personnel who should conduct the tests. Our recommendations are provided in the following subsections.

SAMPLING METHODOLOGY

Given the substantial number of products that may require testing, we propose a sampling procedure that will minimize the number of tests required and, at the same time, ensure that noncompliant products are identified.[2] Moreover, the process is cost-effective because most products will be accepted or rejected with one or two tests.

For CVS components that the manufacturer has indicated are Y2K compliant or noncompliant equipment that has been corrected or replaced, we recommend a procedure that is based on three assumptions:

- υ   The manufacturer states the product is compliant.

- υ   Items with identical model numbers or software version numbers have the same date functionality encoded on the microchip or within the software/firmware.

- υ   Chips of the same design and similar software versions will function in the same way in all items in a model line.

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[2] Our approach differs from traditional quality control procedures that involve selecting samples from large production runs. These techniques usually apply the normal, binomial, or Poisson distributions based on large numbers. Typically, this method is used to determine, for example, the percentage of a production run that does not meet a predetermined quality standard, such as function failure prior to a specified time period or measurements within tolerance limits. For these purposes, which could involve numerous causes for failure, a substantial number of items may need to be tested. By contrast, the USDA testing involves only one narrow potential problem that is independent of other possible equipment malfunctions.

For the proposed test, one item of a single model number should be selected for testing:

- υ If the item functions properly, all items within the group should be accepted as being compliant without further testing.

- υ If the item fails, it is probable that all others with the same chip also will fail. Nonetheless, to be sure that the first test was properly performed and that the failure was not caused by an unrelated malfunction, a second item should be tested:

  - ™ If the second item also fails, all items within the same group (i.e., items with the same model number) should be rejected.

  - ™ If the second item functions properly, up to 19 additional items should be tested. If all 20 items function properly, the product should be considered Y2K compliant. If another item fails, the group should be rejected.

If USDA has no compliance information from the manufacturer, more rigorous sampling is required. The sample size required will depend on assumptions about

- υ the number of date chips and or software versions used for the same model and

- υ the distribution of those chips and/or software versions throughout the population of products.

Assuming no more than three different date chips or software versions are used in the same model, and each of these is distributed evenly within the same product model, USDA needs to sample up to 10 items to be 95 percent certain that at least one of each type of chip/software version is tested. If all 10 items function properly, then USDA should accept the product. If any item fails, the group should be rejected.

As with any sampling procedure, our approach does not ensure 100 percent reliability. In some cases, the approach may be inappropriate because the consequences associated with a failure of a particular item are simply too great. In this situation, the individual item should be tested to further ensure compliance. The USDA agency or office should identify any of these items during the validation planning.

SELECTION OF ITEMS FOR TESTING

Once it has determined the sample size required to validate a particular product, the USDA agency or office should select the specific items to be tested. Items should be selected from the inventory in a manner that will minimize the overall testing costs, the time to perform the tests, and the disruption to the organization.

In that selection process, the USDA agency or office should consider such factors as the location of the items and the number of people required to test them. Clearly, the cost, time, and organizational disruption will be minimized if enough items are available in one location to meet the criterion for sample size and could therefore be tested by one person.

TESTER QUALIFICATIONS

The qualifications of people to test USDA's non-IT products will depend on factors such as the complexity of the product and the complexity of the test required to validate Y2K compliance. A majority of the non-IT products to be validated can be easily and safely tested simply by reprogramming them to simulate the January 1, 2000, conditions. Those tests can be done on-site by USDA personnel.

Products with multiple components, such as security systems, may require special testing equipment and expertise or may pose a safety hazard during the testing process. The Y2K compliance of those products should be validated by a local qualified contractor, preferably one with which USDA already has a maintenance or service contract. In most cases, the contractor will be able to test the equipment on-site.

For product renovations or replacements that are done by a contractor, the USDA agency's procurement office should make sure that the contract includes Y2K compliance validation testing as a contractor requirement.

TEST PACKAGES

To ensure that all items of a product type are tested consistently agencies should use the Y2K test instructions and Y2K test worksheet located in the appendix of this document.

Conduct Product Tests

Product testing is the responsibility of the USDA agencies (Agricultural Research Service, Food Safety and Inspection, Forest Service, etc.) that own items selected for testing. That responsibility includes choosing appropriate USDA personnel to be testers and, for more complex products, hiring local qualified contractors or contractors with which it has maintenance or service contracts. It also includes distributing test packages to USDA and contractor personnel and reporting test results to the appropriate office. As the results are submitted to the agency or office, additional tests may need to be performed if failures occur as outlined in the sampling methodology. These additional items should be selected and tested if necessary.

If a piece of equipment is connected to a PC, the PC should be tested separately to ensure it is Y2K compliant. Examples of equipment that uses PCs are lab equipment, energy management systems, and security systems. Most PC manufacturers

have easy-to-follow Y2K testing protocols for their specific models posted on their Web site. The results of the PC tests should be reported along with the results for other system components.

Analyze Test Results

As tests are completed, USDA should analyze the results to determine whether the product is compliant or noncompliant. All products determined to be noncompliant should be evaluated further to determine the appropriate follow-up action. Follow-up actions include repairing the product, replacing the product, or taking no action. Typically, a decision to repair or replace a noncompliant product should be based on a cost-effectiveness analysis. Doing nothing may be appropriate in instances in which the anticipated correction costs are prohibitive and the product's anticipated Y2K failure would be a nuisance but would not significantly affect the overall operation of the component.

TESTING SCHEDULE

The anticipated duration for each phase of testing is as follows:

- υ Develop testing protocol—1 week

- υ Identify products to be tested—1 week

- υ Develop test plans—1 week

- υ Conduct tests and submit results—2 to 3 months

- υ Conduct follow-up tests if necessary—1 month.

APPENDIX. SAMPLE TEST INSTRUCTIONS AND WORKSHEET

To ensure that all items of a product type are tested consistently, general instructions, specific testing procedures, and a standard reporting form must be used and distributed to the personnel performing the validation tests. The following instructions and worksheets have been developed to test non-IT equipment.

Y2K Test Instructions: USDA Non-IT Equipment

Step	Action Required
1	**Review equipment documentation.** Review your user manuals, as-builts, and any other pertinent information on the equipment you are about to test to gain information on date/clock functions that may or may not exist, and whether adjusting those date/clock functions will affect equipment passwords, nullify warranties, etc. For PCs, refer to manufacturer Web sites for test instructions.
2	**If necessary, seek technical expertise.** • If necessary, schedule the test date so that your local equipment manufacturer, vendor's representative, or O&M contractor—the service provider who is most knowledgeable about the technical aspects of the equipment—can attend to provide technical support. • If this equipment is connected to a system (e.g., a chiller is "connected" to cooling towers, whose operation is critical to the use of the chiller), then it is critical to have vendor representatives attend the system test on the same day. • Also, if necessary, schedule the test so that your local agency technical representative (e.g., your LAN administrator) can help you determine if date/clock functions exist, or if the test you are about to perform might affect the operation of other networked equipment.
3	**Verify that the equipment exists and is in use or is expected to be in use on January 1, 2000.** Does the product exist, is it currently in use, is it expected to be in use on January 1, 2000, and does the agency own it? (If it is leased, it is the responsibility of the lessor to confirm Y2K compliance.) If you answered no to any of the questions, stop the test. If new equipment has replaced the equipment identified in the Y2K inventory survey, test the new equipment.
4	**Verify the equipment has date/clock functions.** Does the equipment have a date/clock functions? If you answered yes, proceed to Step 5. If you answered no, stop the test.
5	**Verify password operation.** If the unit is password protected, attempt to extend the password validation date beyond the test dates. Were you able to extend the validation date of your password? If you answered yes, proceed to Step 6. If you answered no, stop the test.
6	**Back up all software, data, and configurations used by the equipment.** Does the equipment use software, store data, or produce data? If you answered yes, back up all software, configurations, and data that might be lost by an unsuccessful test. Make a "hard copy" of the data using paper printouts, floppy disks, or both. If the equipment uses software, stores data, or produces data, were you able to successfully back it up? If you answered no, stop the test.
7	**Review software license for expiration date.** Does the software have an expiration date? If it does, indicate the expiration date on the worksheet and decide whether to proceed based on the expiration date (i.e., if any of the testing dates exceed the software expiration date, stop the test).

8	**Isolate the equipment.** Disconnect the equipment from the LAN and isolate it from all linked equipment that could be affected by failure of the equipment you are about to test. The test should be done on the stand-alone unit, independent of all other devices.
9	**Test the isolated equipment with a regressed date.** Turn the isolated unit's date/clock backward to October 1,1995, 8:15 a.m. Turn off the power to the equipment, then power the unit back up. If the unit retains the regressed date and functions properly, then proceed to Step 10. If it does not function properly, stop the test.
10	**Test the isolated equipment with Y2K test dates.** • Advance the date/clock to **December 31, 1999,** 11:55 p.m. Wait until the unit has rolled over to the year 2000 (>6 minutes). Turn off the power to the equipment, then power the unit back up and check to see how the date is interpreted. If the equipment interprets the date as January 1, 2000, Saturday (and not as 1900), and if the equipment operates properly, then proceed with this test. If it interprets the new date as 1900, reset the date/clock to today's date, and return the unit to normal operation. If the unit tested OK with the advanced date, proceed to test the remaining test dates, which are required for total Y2K compliance. If any date results in improper operation, stop the test. (Proper operation means that the unit performs with correct date rollovers and that all output, transmitted data, and log and audit reports are accurate. All display dates will be accurate and all files will migrate properly where applicable.) • Advance the date/clock to **February 28, 2000**, 11:55 p.m. Wait until the unit has rolled over into the leap year, February 29, 2000, Tuesday (>6 minutes). Turn off the power, then power the unit back up. Check that the equipment operates properly, and that the new date was interpreted correctly. If the leap year date is interpreted correctly and the unit operates properly, then proceed. • Advance the date/clock to **February 29, 2000**, 11:55 p.m. Wait until the unit has rolled past the leap year, to March 1, 2000, Wednesday (>6 minutes). Turn off the power, then power the unit back up. Check that the equipment operates properly, and that the new date was interpreted correctly. If the new date is interpreted correctly and the unit operates properly, then proceed. • Advance the date/clock to **December 31, 2000**, 11:55 p.m. Wait until the unit has rolled to January 1, 2001, Monday (>6 minutes). Turn off the power, then power the unit back up. Check that the equipment operates properly, and that the new date was interpreted correctly. If the new date is interpreted correctly and the unit operates properly, then proceed.
11	**Test the equipment in a system test.** If the equipment being tested is part of a larger system of components, test each of those components, then connect them back together as a system (e.g., a chiller may need to be reconnected to cooling towers, a chemical feed pump, and an energy management system). If the equipment operates as part of a system, connect all components and repeat Steps 9–10 of the test.

Y2K Test Worksheet: USDA Non-IT Equipment

(Information to Be Provided by Field Tester)

Tester name and organization	
Tester telephone and fax numbers and e-mail addresses	
Test date	
Equipment name Model number	
Equipment location (building address)	
Can you locate the equipment and is it in use?	☐ Yes ☐ No
Does the agency own the equipment?	☐ Yes ☐ No
Does the equipment have date/clock functions?	☐ Yes ☐ No
If the equipment utilizes passwords, will they be valid if you adjust the date/clock functions?	☐ Does not utilize passwords ☐ Yes ☐ No
If the equipment stores data, did you successfully back up all data before conducting the test?	☐ Does not store data ☐ Yes ☐ No
Could you set the date/clock functions back?	☐ Yes ☐ No
Could you advance the date/clock functions?	☐ Yes ☐ No
Was the isolated equipment test successful for all Y2K dates?	☐ Yes ☐ No
Did you perform a system test?	☐ Yes ☐ No
Was the system test successful for all Y2K dates?	☐ Yes ☐ No
Please describe as specifically as possible any failures that occurred during the testing.	
Please provide any information you may have gathered on the costs (of repair/replacement) in order to make this equipment Y2K compliant.	